

Replacement Claims

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:
a substrate; and
a stiffener molded to the substrate.
2. The device of Claim 1, wherein the substrate is selected from a group consisting of a laminated polymer, a polyimide layer, a bismaleimide triazine (BT) resin, an FR4 laminate, an FR5 laminate, a CEM1 laminate, a CEM3 laminate, and a ceramic metal frame.
3. The device of Claim 1, wherein the substrate has a thickness of less than about 75 microns.
4. The device of Claim 1, wherein the substrate has a thickness of less than about 50 microns.
5. The device of Claim 1, wherein the substrate has a thickness of less than about 35 microns.
6. The device of Claim 1, wherein the stiffener has a thickness of less than about 100 microns.
7. The device of Claim 1, wherein the stiffener has a thickness of less than about 75 microns.
8. The device of Claim 1, wherein the stiffener has a thickness of less than about 50 microns.
9. The device of Claim 1, wherein the molded stiffener comprises a thermoplastic.
10. The device of Claim 1, wherein the molded stiffener comprises a thermosetting polymeric material.
11. The device of Claim 1, wherein the thermal coefficient of expansion of the molded stiffener and the substrate correspond such that heating expands both the molded stiffener and the substrate approximately equally.

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29-38
assembly 38-37

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method 44-

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12. The device of Claim 1, wherein the molded stiffener is transfer molded to the substrate.
13. The device of Claim 1, wherein the molded stiffener is injection molded to the substrate.
14. The device of Claim 1, wherein the molded stiffener is spray molded to the substrate.
15. The device of Claim 1, wherein the molded stiffener is molded to the substrate with an encapsulating material.
16. The device of Claim 1, wherein the molded stiffener comprises at least one cross member.
17. The device of Claim 1, wherein the molded stiffener is in a form selected from the group consisting of a grid, a lattice, a grille, and a web.
18. The device of Claim 1, wherein the substrate comprises two or more compartments for receiving die therein.
19. The device of Claim 1, wherein the molded stiffener is sized to correspond to at least one of a length and a width of the substrate.
20. The device of Claim 1, wherein the substrate is sized to correspond to at least one of a length and a width of the molded stiffener.
21. The device of Claim 1, wherein the molded stiffener forms an enclosure for receiving an encapsulating material therein.
22. The device of Claim 1, wherein the substrate comprises index holes.

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23. The device of Claim 1, wherein, prior to the stiffener being molded to the substrate, the substrate is in reel form.
24. A semiconductor device comprising:
a substrate comprising a first surface, a second surface, and a periphery; and
a stiffener molded to the first surface of the substrate proximate the periphery.
25. The device of Claim 24, wherein the stiffener protrudes from the first surface of the substrate.
26. The device of Claim 24, wherein the first surface of the substrate comprises a recess formed therein, the stiffener being molded to the substrate within the recess.
27. The device of Claim 26, wherein the molded stiffener is flush with the first surface of the substrate.
28. The device of Claim 24, wherein the molded stiffener comprises at least one cross member.
29. A semiconductor device comprising:
a substrate comprising a first surface and a second surface;
a first stiffener molded to the first surface of the substrate; and
a second stiffener molded to the second surface of the substrate.
30. The device of Claim 29, wherein the first stiffener and the second stiffener comprise different configurations.
31. The device of Claim 29, wherein the first stiffener and the second stiffener comprise different dimensions.

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32. The device of Claim 29, wherein the first stiffener protrudes from the first surface of the substrate and the second stiffener is disposed within a recess and flush with the second surface of the substrate.
33. The device of Claim 29, wherein the second stiffener protrudes from the second surface of the substrate and the first stiffener is disposed within a recess and flush with the first surface of the substrate.
34. A semiconductor assembly comprising:
a substrate having a first surface, a second surface, and a periphery;
a die disposed on the first surface of the substrate; and
a stiffener molded to the first surface of the substrate.
35. The assembly of Claim 34, wherein the stiffener is disposed at the periphery of the substrate.
36. The assembly of Claim 35, further comprising a second stiffener molded to the second surface of the substrate and a second die disposed on the second surface of the substrate.
37. The assembly of Claim 34, wherein the substrate is selected from a group consisting of a laminated polymer, a polyimide layer, a bismaleimide triazine (BT) resin, an FR4 laminate, an FR5 laminate, a CEM1 laminate, a CEM3 laminate, and a ceramic metal frame.
38. A semiconductor die package comprising:
a substrate comprising a first surface, a second surface, and a periphery;
a die disposed on the first surface of the substrate within the periphery;
a stiffener molded to the first surface of the substrate at the periphery; and
an encapsulating material covering the die.

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39. The package of Claim 38, wherein the substrate is selected from a group consisting of a laminated polymer, a polyimide layer, a bismaleimide triazine (BT) resin, an FR4 laminate, an FR5 laminate, a CEM1 laminate, a CEM3 laminate, and a ceramic metal frame.
40. The package of Claim 38, wherein the package is formed by a transfer molding process.
41. The package of Claim 38, wherein the encapsulating material is at least partially bounded by the molded stiffener.
- a1 42. The package of Claim 38, wherein the package comprises a second stiffener secured to the second surface of the substrate.
43. The package of Claim 42, wherein the second stiffener is molded to the second surface of the substrate.
44. A method of securing a stiffener to a substrate comprising the steps of:
providing a stiffener material and the substrate, the substrate comprising a first surface, a second surface, and a periphery;
molding the stiffener material to the first surface of the substrate proximate the periphery;
and
permitting the stiffener material to harden to form a molded stiffener secured to the substrate.
45. The method of Claim 44, wherein the step of molding comprises at least one of transfer molding, injection molding, and spray molding.
46. The method of Claim 44, wherein the step of molding comprises applying an encapsulating material to the substrate to form the molded stiffener.

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47. The method of Claim 44, wherein the step of hardening comprises at least one of heating the stiffener material, permitting the stiffener material to cool, curing the stiffener material by means of a catalyst, and curing the stiffener material by exposure to radiation.

48. A method of molding a stiffener to a lead frame assembly comprising the steps of:
providing the lead frame assembly, the lead frame assembly comprising a substrate having a first surface, a second surface, and a periphery, and two or more die disposed on the first surface of the substrate;

providing a stiffener material;

molding the stiffener material to the first surface of the substrate to form a molded stiffener;

and

Q1 singulating the lead frame assembly, having the molded stiffener thereon, to separate the two or more die.

49. The method of Claim 48, further comprising, prior to the singulation step, the step of encapsulating the two or more die disposed on the lead frame assembly.

50. The method of Claim 49, wherein the encapsulating step comprises dispensing an encapsulating material onto the die, and the molded stiffener provides at least one boundary to contain the encapsulating material therein.

51. A method of forming a semiconductor die package comprising the steps of:

securing a die to a first surface of a substrate;

molding a stiffener material to the first surface of the substrate to form a molded stiffener thereon; and

encapsulating the die and the molded stiffener with an encapsulating material to form the semiconductor die package.

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52. The method of Claim 51, wherein the step of encapsulating comprises inserting the substrate with the die and the molded stiffener disposed thereon into an opening between two mold plates, and removing the package from the mold plates after the encapsulating material has hardened.

53. A method of forming a semiconductor die package comprising the steps of:
mounting a die on a first surface of a lead frame;
molding a stiffener to the first surface of the lead frame;
applying an encapsulating material to the die and the stiffener; and
permitting the encapsulating material to harden to produce the semiconductor die package.

54. The method of Claim 53, wherein the molded stiffener provides at least one of stiffening the lead frame, and increasing rigidity of the lead frame.

55. (new) A semiconductor device, comprising:
a substrate comprising first and second surfaces, and a periphery; a thermoplastic material molded on the substrate proximate the periphery to stiffen the substrate.

56. (new) A semiconductor device, comprising:
a substrate comprising first and second surfaces, and a periphery; a thermoplastic material molded on the substrate proximate the periphery to stiffen the substrate, and
a die mounted on the first surface of the substrate.

57. (new) A semiconductor device, comprising:
a substrate comprising first and second surfaces, and a periphery; a thermoset plastic material molded on the substrate proximate the periphery to stiffen the substrate, and
a die mounted on the first surface of the substrate.

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58. (new) A semiconductor device, comprising:

a substrate comprising first and second surfaces, and a periphery; a thermoplastic material molded on the substrate proximate the periphery to stiffen the substrate, and means for handling the substrate by a processing mechanism, said handling means disposed along the periphery of the substrate.

59. (new) The device of Claim 58, wherein the handling means comprises a plurality of index holes proximate the periphery of the substrate.

60. (new) The device of Claim 58, wherein the substrate comprises a lead frame.

61. (new) A semiconductor device, comprising:

Q2 a lead frame comprising first and second surfaces, and a periphery; a thermoplastic material molded along the periphery of the lead frame to stiffen the lead frame, and a plurality of index holes proximate the periphery of the substrate for handling the lead frame by a processing mechanism.

62. (new) A method of forming a semiconductor device, comprising the steps of:

providing a substrate comprising first and second surfaces, and a periphery; and
molding a stiffening material to the first surface of the substrate proximate the periphery.

63. (new) A method of forming a semiconductor device, comprising the steps of:

providing a substrate comprising first and second surfaces, and a periphery;
applying a stiffening material to the first surface of the substrate proximate the periphery by a molding process; and
hardening the stiffening material on the substrate.

64. (new) The method of Claim 63, wherein the step of applying the stiffening material comprises a transfer molding process.

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65. (new) The method of Claim 63, wherein the step of applying the stiffening material comprises a injection molding process.
66. (new) The method of Claim 63, wherein the step of applying the stiffening material comprises a spray molding process.
67. (new) The method of Claim 63, wherein the stiffening material comprises a thermoplastic material.
68. (new) The method of Claim 63, wherein the stiffening material comprises a thermosetting polymeric material.
69. (new) The method of Claim 63, wherein the step of hardening the stiffening material comprises heating the stiffening material.
70. (new) The method of Claim 63, wherein the step of hardening the stiffening material comprises cooling the stiffening material.
71. (new) The method of Claim 63, wherein the stiffening material comprises a catalyst, and the step of hardening the stiffening material comprises curing the stiffening material.
72. (new) The method of Claim 63, wherein the step of hardening the stiffening material comprises curing the stiffening material by exposure to a radiation.
73. (new) A method of forming a semiconductor device, comprising the steps of:
 providing a substrate comprising first and second surfaces, and a periphery;
 applying a flowable stiffening material to the first surface of the substrate proximate the periphery;
 hardening the stiffening material on the substrate; and

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mounting a die on the first surface of the substrate.

74. (new) A method of forming a semiconductor device, comprising the steps of:
providing a substrate comprising first and second surfaces, and a periphery;
molding a plastic material to the first surface of the substrate proximate the periphery;
hardening the plastic material on the substrate to form a molded stiffener; and
mounting a die on the first surface of the substrate.
75. (new) The method of Claim 74, wherein the step of molding comprises a process selected from the group consisting of transfer molding, injection molding, and spray molding.
76. (new) The method of Claim 67, further comprising encapsulating at least a portion of the die.
77. (new) A system for forming a semiconductor device, comprising:
means for molding a plastic material to a surface of a substrate proximate a periphery of the substrate; and
means for hardening the plastic material on the substrate to form a molded stiffener.
78. (new) The system of Claim 77, wherein the molding means is selected from the group consisting of a transfer molding apparatus, injection molding apparatus, and spray molding device.
79. (new) The system of Claim 77, wherein the hardening means is selected from the group consisting of a heat source, a cooling apparatus, and a radiation source to cure the plastic material.
80. (new) The system of Claim 77, wherein the hardening means comprises a catalyst functional to cure the plastic material, the plastic material comprising the catalyst.
81. (new) A system for forming a semiconductor device, comprising:
a substrate for mounting a semiconductor die thereon;

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a liquid stiffening material capable of being molded onto the substrate and hardening;
means for molding a plastic material to a surface of the substrate proximate a periphery of the substrate; and
means for hardening the stiffening material on the substrate to form a molded stiffener.

82. (new) The system of Claim 81, wherein the substrate comprises a leadframe.

83. (new) The system of Claim 82, wherein the leadframe comprises means for handling the leadframe by a processing mechanism.

84. (new) The system of Claim 82, wherein the handling means comprises a plurality of index holes proximate the periphery of the substrate.
